

# Automation of Source Data for Birth Certificates

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**D**URING THE PAST several years developments in computer technology have provided significantly new concepts for use in the national and State offices processing vital statistics. The computer can process information and perform algorithmic and logical functions with consistency at hitherto unthought of speeds, and planners of data processing systems are examining the possibility of having the computer perform some of the burdensome and costly data input preparation routinely assigned to clerks. Recent improvements in data storage and retrieval techniques and equipment have suggested the possibility of computer-based systems which might enable good searching of vital records and permit extraction of selected information in hard copy form for certification and research.

Input to all operating computer systems for vital records currently requires manual preparation of punched cards from data in coded form taken from the original documents or facsimiles, followed by mechanical conversion of the cards

to magnetic tape by keypunch for computer processing. In most systems keypunching is preceded by editing and coding steps in which the information to be processed by the computer is checked for completeness, accuracy, and adherence to specified standards of acceptability. Numerical codes are entered on the documents to identify the classifications for statistical processing of various items of data.

Characteristically, in the editing, coding, and keypunching operations of vital statistics systems, there are shortages of personnel, need for special training, and difficulty in maintaining satisfactory levels of consistency and accuracy in performance. At present, although the computers have a storage capacity of hundreds of millions of characters and processing speeds calculated in billionths of a second, the basic steps required for data input to computer processing systems continue at a pace considered slow and difficult even in precomputer days.

The development of techniques which might exploit the computer's full potential as a replacement for human effort would represent a major breakthrough in the processing of vital records. One proposed method is preparing the original birth certificates at the hospital on an electric typewriter which simultaneously produces perforated paper tape carrying the same information that is typewritten on the certificate.

Perforated paper tape has been used for data input to computers for some time. In many pro-

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grams in which hard copies of source documents are typed and which require subsequent computer processing of this data, savings are substantial if perforated paper tape is produced, as a byproduct of typing the source document, to serve as the data carrier for the computer input. The typewriter that prepares the paper tape also offers advantages in preparing the source documents; it can be programed to space automatically, either horizontally or vertically, and to position the document correctly for typing entries in predetermined positions. The programed tape can also trigger the automatic typing of data common to groups of records. These automatic features of tape-generating typewriters frequently permit the complete typing of properly designed documents in less time than if the documents were prepared on standard typewriters.

### The Test

The National Center for Health Statistics (NCHS) asked the New York City Department of Health to cooperate in a test of the feasibility of a technique of data automation at the source, that is, the generation of paper tapes simultaneously with the preparation of birth certificates in hospitals.

Problems of management and cost in preparing birth certificates in hospitals under conditions requiring special equipment and personnel trained in its use were to be explored. Another major consideration was to identify other possible uses in the hospital for the tape-generating typewriters which might offset the cost of the equipment to the vital records system.

The department of health negotiated with several large hospitals, and three Manhattan hospitals volunteered for the experiment. One was a municipal hospital under administrative control of the city's department of hospitals, in which about 3,000 babies are born annually, and two were voluntary hospitals, in each of which about 2,500 babies are born annually. In all three hospitals the face of the New York Certificate of Birth is usually typed and the reverse side, containing confidential medical data, is often handwritten, usually by the attending physician.

The plan for the test required a cooperating hospital to prepare its birth certificates on a

special typewriter installed for the study. The output tape produced by this machine—the tape produced as a byproduct of the typing—was to be sent daily to the health department with the birth certificates. Missing from this output tape was the permanent birth certificate number assigned at the health department. Instead, the tape contained the case number used in the hospital to identify the birth record of the newborn baby.

An identical typewriter at the health department was to be used to prepare an auxiliary output or conversion tape, carrying the code number of the hospital, the hospital's case number, and the certificate number assigned by the health department. Both output tapes—the original prepared in the hospital and the conversion tape prepared in the health department—were to be sent weekly to the National Center for Health Statistics.

The typewriter at the health department also prepared a corrected tape when a certificate was corrected. This corrected tap contained the hospital's identity number, the health department certificate number, the changed item number, and the new entry for that item.

The Dura Mach-10 typewriter was selected for the experiment and machines were installed in the three hospitals and in the Manhattan office of the health department's bureau of records and statistics. Operating features of the equipment were demonstrated by the manufacturer for representatives of the hospitals' administrative staffs, who were urged to find other uses for the machines when they were not used in preparing birth certificates. If enough such jobs could be found, the hospital might be able to buy the machine and have trained personnel available to operate it.

With the cooperation of the company's representatives, the center prepared program tapes for use with the typewriters. These tapes were spaced for uniform entry of the birth certificate information in all three hospitals and were identical except for the automatic typing of a different hospital name and a different pattern of case numbers for each hospital.

The hospitals and the health department each hired one operator. Complete instructions prepared by the center and the company covering the operation of the typewriter were given to

the four operators. They were told when abbreviations could or could not be used, how to type dates, when to depress the "start" key for automatic spacing, and when to align the printing by manually repositioning the certificate.

The actual preparation of birth certificates was started in mid-November 1965. The last certificate for NCHS was completed about mid-March 1966—a 4-month test period. During this time, the three hospitals filed 771, 995, and 776 certificates, a total of 2,542 birth certificates.

### **Difficulties Encountered**

Paper tapes received at the center during the first several weeks of the study revealed difficulties of various kinds in the management of the typing operations in the hospitals. The program tapes used in the three hospitals did not provide for identical handling of all items, and signals automatically punched into the tapes under program control for the identification of fields were not uniform. Also, operators were typing a lowercase "L" for the digit "1" as is done on the standard typewriter. After the program tapes from the three hospitals were compared by the NCHS staff, new standardized program tapes were supplied to the hospitals, and the operators were instructed in the use of the newly supplied special digit 1 key.

Early in the experiment it was discovered that the output tapes were frequently damaged by handling and folding before transmittal to the health department. To eliminate the difficulty of feeding damaged tape through mechanical equipment for conversion to magnetic tape, a spool or reel was installed on each typewriter on which the tape could be wound, and paper boxes (costing about 5 cents each) were obtained for shipping the tapes to Washington.

A procedural difficulty related to the completion of birth records also became apparent early in the experiment. New York City's law requires that live births be reported to the health department within 48 hours. Before the test, preparation of birth certificates was initiated on the delivery floor immediately after the birth. The attending physician completed the back of the certificate which carries the medical information related to the birth. He would then sign the front of the certificate even though it con-

tained none of the information to be entered on this side of the record. The certificate was then sent to a typist who completed the face of the certificate before transmitting it to the health department.

Preparation of the perforated paper tape required that both sides of the certificate be typewritten. The information needed by the typist consisted of the personal data on the parents usually entered on a specially prepared form at the time of admission. The typist also needed the previous obstetrical history and the course of the current pregnancy and the details of the delivery. After being typed the certificate was signed by the attending physician.

In one hospital, difficulties in locating physicians to obtain signatures caused a delay in the transmittal of the birth certificates to the health department. This difficulty was overcome by having the various physicians on private service sign, in advance, a supply of blank birth certificates. The typist then used these, selecting the proper presigned certificate for each record, which she prepared on the tape-generating typewriter.

The experience of the hospitals indicates that preparing birth certificates on a program-controlled typewriter takes less time than on a standard typewriter. In one hospital, the misconception that the records had to appear on the output tapes in order of the babies' births resulted in frequent delays. If some information needed for the certificate was missing, the typist stopped completely, leaving a partly completed certificate in the machine, until the missing information was supplied.

In another hospital, certificates were completed in 3 to 5 minutes in contrast to 10 minutes when the standard manual typewriter was used. The third hospital, which formerly typed certificates in 6 minutes, reduced this time to 5 minutes with the new typewriter.

Both hospitals, where estimates of time were available, reported that the typewriters were also used intermittently to prepare form letters, memorandums, and routine operative reports. These hospitals also reported that the quality of the finished copies was superior and the work was generally performed faster on the new typewriters than when using the standard typewriter.

### Processing the Tapes at NCHS

Processing at the National Center for Health Statistics was limited to paper tapes prepared at the hospitals from February 1 through March 15, 1966, or a little more than one-third of the test period. It was assumed that records for this part of the experiment would represent the highest level of performance that could be equated with an established ongoing system. The records processed for the three hospitals numbered 277, 411, and 286, a total of 974 certificates.

Processing at NCHS consisted of passing the paper tapes through a converter attached to a keypunch machine which automatically punched the information contained on the tapes onto 80-column tabulating cards. These cards were arranged by date of receipt from the hospitals and were completely listed. The listings were then examined to determine the feasibility of entering the data into the computer for further processing. In the routine operation of an established system, the perforated paper tapes would be converted directly to magnetic tape offline.

The listed records frequently deviated significantly from the standards and instructions supplied to the hospitals, and most of the records on the tapes would clearly present major problems in computer processing. The most common errors were failure to enter the appropriate end-of-record character signal and not following instructions for correcting typing errors.

In many records, the specially designed characters indicating the separation of items within the certificate were not used uniformly, thus making it impossible for the computer to select and arrange the separate items of information for processing. More than an estimated 50 percent of the records examined would probably be rejected by the computer as not processable—that is, as records in which the computer program could not separately identify and account for the required data entries which it was to process.

### Discussion

This experiment indicates that every hospital cannot be relied upon to produce satisfactory paper tape continually and consistently on a current basis without close surveillance, quality

control, and feedback of information from the processing operation. Deviations from established standards and instructions and difficulties and delays caused by misconceptions about the requirements of the system can be corrected only through close and continued liaison between the data processing unit in the health department and the hospitals where the tapes are prepared. This need for continued liaison would require the health department to make a substantial commitment of personnel to manage the system efficiently.

The difficulty appears to be in maintaining proper orientation of the hospitals to the technical requirements of the system. The hospitals' responsibilities in preparing legible and complete birth records are strongly established and fully recognized. The certificates in hard copy form prepared in the experiment were of uniformly high quality, reflecting the hospitals' care in fulfilling their acknowledged obligations to the vital records system. The byproduct of the experiment, however, was a thing apart from the normal function of preparing the required records.

The paper tapes were produced by an automatic, mechanical operation during the typing of the certificates. They were not reviewed by the hospital staff, and as long as the machines continued to grind out the tapes automatically and the hard copy certificates appeared to be satisfactory, the hospital staff was unaware of the problems. Perhaps the increasing use of computers by hospitals for administrative management and scientific data processing may, in the future, help to develop the required re-orientation of the persons preparing information to be processed to the needs of the computer.

Although it appears that the typewriters used in the study provided advantages in speed and quality of product over standard typewriters in preparing birth certificates and in other routine typing operations, it is unlikely at present that hospitals generally could justify the purchase of typewriters costing about \$3,000 each to use in routine preparation of records. Hospitals using computers, however, might find the tape-generating typewriter more efficient than other input preparation devices. Korein and co-workers have described the use of such type-

writers to type neuroradiological reports with simultaneous preparation of computer input (1-3).

Possibly the health department might purchase and install the equipment for use in the larger hospitals, and information from certificates from the smaller institutions and sources other than hospitals could be retyped, generating the paper tape in the department's own data processing installation.

The hospitals to be supplied with tape-generating equipment would range from 32, if only institutions with 2,000 or more live births per year were considered eligible, to 64, if the equipment were given to all hospitals with 1,000 or more live births annually (see table).

In either event, installing and maintaining the equipment and providing personnel to operate and keep the installations in step would cost more than the present methods. The system would still be expensive even if the cost of the proposed system were shared equally by the local department and Federal Government, and if all hospitals or registration areas adopted the system. The government could save some of the expense because the center would then be able to eliminate its own coding and keypunching operations.

Another cost comparison of interest to the New York City Department of Health was suggested by the test. In two hospitals where reliable measures of performance were made with the equipment, it was reported that it took 3 to 5 minutes to type a certificate. Using these figures, it becomes possible to estimate the cost

of a centrally located tape-generating operation in which all 165,000 birth certificates, which may be filed in the City of New York in 1 year, are copied onto paper tape. (In New York City it costs \$0.388 to code, punch, and verify the tabulating cards for each birth certificate.)

Assuming a production time of 5 minutes a certificate, 11 employees are needed to complete a year's certificates, two fewer than are now needed to code and punch the cards for 1 year. This represents a saving of about \$10,000 a year, and with this saving, the cost of the tape-generating typewriters could be recouped in about 4 years.

This estimate does not include verification costs. In the system proposed, verification of input is limited to checking the accuracy of direct transcription of information from the original records and does not include checking for the correct application of the classification and coding rules as does the present system. Several alternative methods of verification could be considered if the system were adopted, including visual comparison of printed typewriter output, obtained while preparing the tapes, with the original certificates.

It is felt that the power of the computer to edit and check tapes, if properly applied to quality control of input data, could substantially reduce the cost of verification. An attractive alternative, from the standpoint of cost, might be the preparation of certificates of birth registration forms from the computer tapes, thus passing on to the public a substantial part of the verification workload.

The mother would receive a certificate of birth registration soon after the receipt of the birth certificate by the health department. The registration certificate would consist of a photostatic copy of the face of the birth certificate which shows the personal data on the parents and the child's name and date of birth. At this time, the health department would correct any errors discovered by the parents without requiring documentary evidence. (Documentary evidence is required for corrections on birth certificates in New York 1 year or more after birth.)

If the paper tape is available, the tape can be fed back into the typewriter on which it was prepared, and the typewriter programed to type

#### Certificates of live birth filed by hospitals and other sources in New York City, 1965

Annual births	Institutions	Certificates filed
Less than 200.....	13	356
200-599.....	5	1,928
600-999.....	15	11,798
1,000-1,499.....	12	13,936
1,500-1,999.....	20	34,836
More than 2,000.....	32	95,855
All hospitals.....	97	158,709
All other sources.....		106
Total.....		158,815

the properly selected data on a preprinted certificate of birth registration form. Any error in the tape for the data typed on the registration notice will appear on the notice.

Performing the work centrally rather than in individual hospitals would result in other advantages. Hospitals filing birth certificates could continue their present procedures. Since typing in the health department would begin after the certificates are assigned their permanent numbers, conversion tapes would not be needed. The number of tapes would be reduced further because instead of having to process 40 to 50 tapes in any 1 day (one tape from each hospital reporting births for that day), it will be necessary to process only the several tapes needed to contain the 500 to 600 birth certificates which may have been filed by the reporting hospitals. This drastic reduction in the number of tapes would simplify the computer input procedures.

The use of centrally located equipment capable of using the full text of birth certificates as input to a computer without the need for coding clerks and keypunch operators offers not only the possibility of significant economies over present methods but also has significant implications whenever retrieval is necessary. What is true of the birth certificates should also be true of the other vital records.

These conjectures about possible economies in computer input operations for vital records are based upon the hypothesis that computer technology is capable of handling full-text, natural language records and of processing this input effectively to meet the requirements of the vital records system for records management and statistical reporting. Reports of developments in computer-based systems for storage and retrieval of records, supported by current undertakings in the development of computer programs designed to classify and code geographic and medical information from natural language input, strongly suggest that the hypothesis is justified.

Development of computer techniques for handling natural language full-text input of vital records data should be pursued. The expectation of economy compared with present methods alone might be spur enough. In addition, such full exploitation of the computer would relieve

the system of the burden of performing the difficult routine functions of coding and keypunching and be responsive to the public's demand for copies of records and to the needs of health research.

### Summary

The National Center for Health Statistics and the New York City Department of Health cooperated in a study to process birth certificates by computer. Three New York hospitals in which about 8,000 births occur annually volunteered for the experiment.

The hospitals prepared the birth certificates on an electric typewriter which simultaneously produced perforated paper tape carrying the same information. The information on these tapes was later converted to punched cards for computer processing.

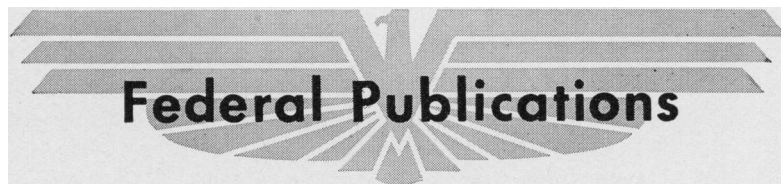
During a 4-month test period the three hospitals filed 2,542 birth certificates. It was estimated that more than 50 percent of the records examined would be rejected by the computer as not processable, that is, as records in which the computer program could not separately identify and account for the required data entries.

In two hospitals where reliable measures of performance with the tape-generating typewriter were made, it took 3 to 5 minutes to type a certificate. Assuming a production time of 5 minutes a certificate for transcribing on paper tape the information on the 165,000 birth certificates filed in the City of New York in 1 year, 11 employees would be needed to complete a year's certificates, two less than are now needed to code and punch the cards. This would save about \$10,000 a year. With this saving, the cost of the tape-generating typewriters could be recouped in about 4 years.

The greatest difficulty uncovered by the study seemed to be in maintaining the proper orientation of the hospitals to the technical requirements of the system. Although the typewriters used had advantages in speed and quality of product over standard typewriters, it is unlikely that hospitals could justify the purchase of typewriters costing about \$3,000 for routine preparation of records and other typing functions. Hospitals using computers, however, might find the tape-generating typewriter more efficient than other input preparation devices.

## REFERENCES

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- (3) Korein, J., Bender, A. L., Rothenberg, D., and Tick, L. J.: Computer processing of medical data by variable-field length format. Statistical analysis of narrative content. *JAMA* 196: 957-963, June 13, 1966, pt. 3.



**Meningococcal Meningitis.** *PHS Publication No. 219; revised 1967; leaflet; 5 cents.* Gives symptoms and present treatment for meningococcal meningitis. Points out that the disease is not highly prevalent in the general population—about 3,000 meningococcal infections of all kinds are reported nationally each year. However, its consequences can be serious.

**The Most for the Least through Sharing.** *PHS Publication No. 930-B-5; 1967; folder.* Suggests that improved patient care at lowest possible cost may be achieved through the appropriate sharing of services, facilities, equipment, and manpower among hospitals and related health facilities.

**Facts of Life and Death.** *PHS Publication No. 600; revised 1967; 33 pages; 30 cents.* Presents data that have been assembled by the National Center for Health Statistics, Public Health Service, to answer questions frequently asked about vital and health statistics for the United States. Includes vital statistics which show events occurring within specified areas. Beginning with 1933, data cover events occurring within the entire conterminous United States; 1959 figures include Alaska and 1960 figures include Hawaii. Information on births, deaths, marriages, divorces, and life expectancy is based on data gathered by the Center's Division of Vital Statistics; es-

timates for selected health conditions, chronic conditions, persons injured, and days of bed disability are from the Division of Health Interview Statistics; health personnel data are from the Division of Health Resources Statistics; and data on reported cases of communicable diseases are from the National Communicable Disease Center.

**Dizziness, Hope Through Research.** *PHS Publication No. 1651; 1967; 22 pages; 20 cents.* Reports that 85 percent of the cases of dizziness seen by doctors are caused by inflammation of the inner ear and 15 percent are caused by arteriosclerosis, hardening of the brain arteries, associated mostly with aging, other neurological ailments, or an allergy. Explains the structure of the human balance system and the relationship between the ear and most types of dizziness. Discusses infections or other conditions which can upset the balance system and cause dizziness. Reviews current methods of treating dizziness caused by ear infection or labyrinthitis, Meniere's disease, tinnitus or head noises, and tumors. Also discusses many of the recent research accomplishments which aid physicians in diagnosing and treating dizziness.

**What's New on Smoking in Print.** *PHS Publication No. 1710; 1967; leaflet.* Companion pamphlet to PHS Publication No. 1707. Describes available materials covering a wide

range of interests and directed to many audiences including young people and adults, smokers and non-smokers. Lists such items as posters from the American Cancer Society and American Heart Association, a kit of materials from the U.S. Children's Bureau, a leaflet on Smoking and Oral Cancer, from the American Dental Association, and a leaflet outlining the nationwide program of the National Congress of Parents and Teachers to prevent millions of seventh and eighth graders from starting to smoke.

### What's New on Smoking in Films.

*PHS Publication No. 1707; 1967; leaflet.* Lists 15 films and filmstrips, ranging from a 4-minute American Cancer Society film on the health benefits of stopping smoking to a 22-minute Public Health Service film, starring Burt Lancaster, on teenage smoking. Films are available for loan, free or at low cost from member organizations of the National Interagency Council on Smoking and Health.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington, D.C. 20201.

The Public Health Service does not supply publications other than its own.

## Program Notes

### ***New Mexico's Female Sanitarians***

Two women were appointed to positions as public health sanitarians in New Mexico in November 1967. That brought to four the number of women in the State employed in these positions.

### ***Role of Alcohol in Home Accidents***

Alcohol plays an important role in home accidents among young adults and the middle aged, according to a study of such accidents among Metropolitan Life Insurance Company policyholders.

The study covered persons aged 15-64 with ordinary life insurance policies who died in home accidents during 1964 and 1965. About one-seventh of the deaths of the 537 male victims and one-fifth of those of the 310 female victims were found to be associated with drinking.

Some of the deaths associated with alcohol resulted from absorption of poisonous gas and vapors (mostly motor vehicle exhausts), falls, going to sleep with a lit cigarette, and firearm accidents.—*Statistical Bulletin* (Metropolitan Life Insurance Company), October 1967.

### ***Vehicle Accidents by City Size***

The hazard of fatal injuries in motor vehicle accidents tends to increase with the size of cities. Data compiled by the National Safety Council show that in the years 1962-66 the highest fatality rate per 100,000 motor vehicles registered occurred in cities of more than 1 million population.

In 1966, these large cities and those with populations of 500,000 to 750,000 recorded identical fatality rates of 32 per 100,000 motor vehicles registered. Small towns with populations of 10,000 to 25,000 had the most favorable record, with a

rate of 19 per 100,000. However, despite growing urbanization, more than two-thirds of the fatalities due to motor vehicle accidents occur in rural places.—*Statistical Bulletin* (Metropolitan Life Insurance Company), November 1967.

### ***New Colorado Vital Statistics Law***

A major innovation in a new vital statistics law that went into effect in Colorado on January 1, 1968, is that all marriages and divorces occurring in the State will be reported to the records and statistics section of the State health department. Another major change is that delayed birth certificates and corrected certificates will be processed by the State or local registrar rather than by the courts.

The new law defines a fetal death as "death prior to the complete expulsion or extraction from its mother of a product of human conception, irrespective of the duration of pregnancy." The Colorado State Board of Health has revised the fetal death certificate accordingly so that all fetal deaths, irrespective of the duration of pregnancy, will be reported on one form rather than on a special one for fetal deaths under 20 weeks' gestation.

### ***Sufficient Time for Each Patient***

Under a new amendment to the New York State Hospital Code, no more than five patients an hour may be scheduled for examination by a hospital outpatient department physician who accepts primary responsibility for health supervision of patients.

A related provision requires that at least 30 minutes be scheduled for the initial patient-physician meeting when a medical history is taken, a physical examination is given, and laboratory tests are made.

### ***Demand for Health Education Films***

Health education films on drug abuse, sex education, venereal disease, and alcoholism were most often requested in 1967 from the Maryland State Health Department's film library. The library filled 4,000 requests for health education films during that year—an alltime record.

Other popular films were those dealing with traffic safety, mental health, adolescents, maternal health, and nutrition.

### ***Prohibition on Idling Engines***

A New York State air pollution rule, which went into effect February 6, 1968, prohibits the idling of bus and truck diesel engines for more than 3 minutes unless the vehicle is stopped in traffic or the engine must be running to keep passengers warm.

The idling restriction amended a rule enacted in 1967 which prohibited the operation for more than 5 seconds of a diesel engine emitting smoke which "will reduce transmission of light by more than 20 percent."

### ***Telephone Seminars for Physicians***

The Medical Communications Center in the University of Wisconsin Medical Library assists physicians throughout the State by providing them with some of the newest medical techniques and data any hour of the day or night. In communicating with the physicians, the center uses the Educational Telephone Network (ETN), the Dial Access Library, and special projectors and films loaned to hospitals.

Weekly ETN seminars provide physicians in 58 hospitals the opportunity to refresh and update their information on diabetes, the disturbed adolescent, multiple sclerosis, surgery techniques—every branch of medicine. Physicians need only lift a telephone receiver to discuss or question.

"We seem to get more questions and discussions with this anonymous setup," said Jerry Keliher, director of the center, "than we might with a large lecture hall—an unexpected dividend."



## Automated Training System for Wheelchair Pushups

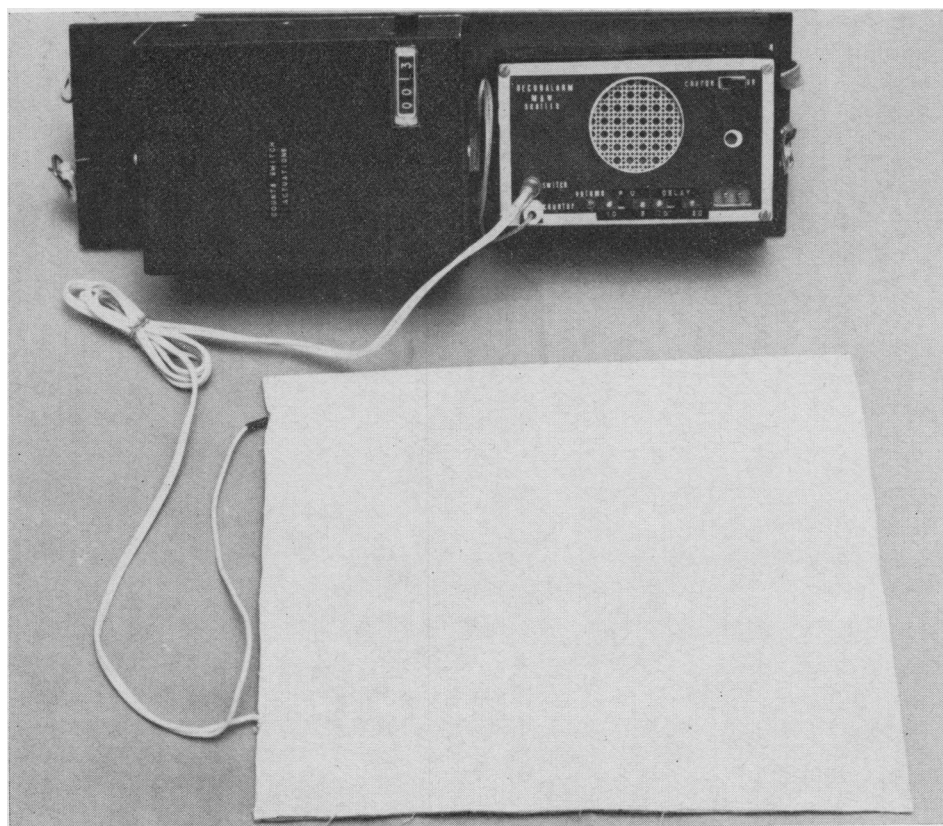


Patients with spinal cord injuries typically lose sensation in their buttocks and lower extremities, resulting in reduced awareness of pressure and infrequent shifting of weight and position when sitting. Concentration of weight in a given portion of the buttocks results in reduced blood flow through the weight bearing areas causing decubitus ulcers.

A decubitus ulcer can be a major threat to the patient's survival if infection or other secondary complications occur. Furthermore, intensive

care is required, and the patient is burdened by the costs of hospitalization, medical care, and lost wages.

The paraplegic is instructed to redistribute his weight over his buttocks by lifting his body from the chair in a wheelchair pushup. While in a rehabilitation center the patient may receive frequent reminders from professional staff to do his pushups, but when he leaves the center such reminders are not given. Skin breakdowns are common in patients who have not established the habit of doing pushups.



Components of the wheelchair pushup training device

The device described automates the training of wheelchair pushups following certain conditioning principles. Even if the instrument cannot help a patient establish this habit of doing pushups, it nonetheless can provide an economically feasible, continuing preventative device. This portable, self-contained unit reminds the patient when it is time to do a pushup, persists in the reminder until he does a pushup of specified duration, and records the frequency with which pushups occur (with or without the remainder).

### Method

The components are as follows.

1. A pressure switch embedded in a 10½- by 13-inch thin, plastic-covered pad which is placed in the seat of the wheelchair.

2. An electronic timer unit containing a tone sounding device, a timing device, a power source, and appropriate circuitry to which the pressure switch is attached.

3. A battery-powered counter which records the number of pushups of a specified duration which occur during a given period.

4. A charging device from which power is derived to drive the timer unit. This device may be fixed in the timer unit or attached separately.

The maximum interval desired between pushups is determined by the patient's physician. This model offers a choice between 10- and 20-minute intervals. The control is a switch on the face of the timer unit. The minimum duration of a pushup is also selected by a switch on the face of the timer unit, and is 5 or 10 seconds in this model.

The timer unit and connected counter are at-

tached to the rear of the wheelchair. The pressure switch is placed in the seat of the wheelchair and is attached by cord to the timer unit.

The sitting interval begins with pressure on the pressure switch occasioned by the patient sitting in the chair. If there has been no interruption in pressure on the switch, a tone of approximately 70 db sounds when the specified time expires. If pressure is removed from the pressure switch by the patient lifting his body completely free of it, the tone will stop, but if pressure resumes on the switch sooner than the selected pushup interval, the tone immediately begins again.

The counter is activated by pressure following a period of no pressure equaling or exceeding the selected pushup interval, so that it records the number of pushups of the selected duration whether or not the tone has sounded. Measures of number of pushups in the absence of the auditory reminder may be obtained and used to assess the effectiveness of training.

We know of no other device that performs the function described here. The closest analogous equipment consists of special kinds of cushions designed to disperse weight over broader areas of the buttocks or powered alternating pressure pads designed to mechanically shift body weight from one portion of the buttocks to another. Neither trains the patient to do pushups himself.—DR. WILBERT E. FORDYCE, *associate professor*, and BERNARD C. SIMONS, *instructor, department of physical medicine and rehabilitation, University of Washington School of Medicine, Seattle. This invention was developed under Vocational Rehabilitation Grant R-T-3.*

**RAVENHOLT, R. T.** (U.S. Agency for International Development), and **FREDERIKSEN, HARALD:** *Numerator analysis of fertility patterns. Public Health Reports, Vol. 83, June 1968, pp. 449-457.*

When the impact of family planning programs on fertility patterns is being measured, it is essential that age and parity, the two foremost determinants of fertility, be fixed. Usually such programs are evaluated by ascertaining their impact on the birth rate. But a lack in some countries of matching numerators and denominators make calculation of even crude birth rates impossible, let alone of fertility rates by age and parity. In these circumstances, "numerator analysis" by means of age-

parity grids provides an alternative.

The effect of a family planning program upon fertility can be indicated by a time series of age-specific parity ratios, for example, the proportion of births that are first births by age of the mother. Analyses such as of median parity by age and of median age by parity may reveal the relative contributions to fertility patterns of the spacing of children and of the number that couples desire. The numerator analysis technique can also be applied to service

statistics, and its application to these data is appropriate for much the same reason, namely, the lack of matching numerators and denominators.

The technique of numerator analysis is exemplified in age-parity grids showing the U.S. fertility pattern for 1965, the pattern of acceptance of intrauterine devices in Taiwan in 1965, and the pattern of acceptance among American Indians of family planning services offered by the Division of Indian Health of the Public Health Service in 1967. Illustrative time series of age-specific parity ratios and of median parity by age are also included.

**FINK, RAYMOND** (Health Insurance Plan of Greater New York), **SHA-PIRO, SAM**, and **LEWISON, JOHN:** *The reluctant participant in a breast cancer screening program. Public Health Reports, Vol. 83, June 1968, pp. 479-490.*

The Health Insurance Plan of Greater New York, a prepaid group practice health plan, launched in December 1963 a screening program for breast cancer among women between the ages of 40 and 64. Sixty-four percent of the study women contacted for examination during the first year were examined.

The participating women were

classified according to the degree of effort required through mailings and telephone calls to gain their participation. A comparison of the reluctant participant group with those who responded readily to the request for participation in the program showed that the reluctant group tended to include higher proportions of Catholics and women who tended

to be low users of medical services generally. Moreover, the reluctant participant tended to be less involved in the medical care program of her medical group than the other participants as measured by her use of outside medical services and her reports as to whether or not she regarded one of the physicians in her group as a regular or family physician. Included in the reluctant participant group was also a comparatively high proportion of women who reported a lack of concern about the possibility of having cancer.

**REID, BARBARA J.** (Army Nurse Corps), **SHIMKIN, MICHAEL B.**, and **BLANK, F.:** *Study of tinea capitis in Philadelphia using case and control groups. Public Health Reports, Vol. 83, June 1968, pp. 497-502.*

A study of tinea capitis, using cases and controls, was carried out in Philadelphia, Pa., in 1965-66. Dermatophytes were isolated from the scalps of 472 of 1,782 persons; 83 percent were of the *Microsporum* species (*M. audouinii* in all but three

instances), and 17 percent were of the *Trichophyton* species.

In families of the case group, infections were found in 47 percent of the 486 boys and in 29 percent of the 335 girls, as well as in 12 percent of the 199 adults. Among families of

the control group, dermatophytes were isolated from 1 percent of the 606 children and none of the 156 adults.

Tinea capitis in families was associated with having a large number of children, especially boys 5-16 years old, and with boys sharing their combs and caps and having less frequent shampoos during winter.

**TYLER, CARL W., Jr.** (National Communicable Disease Center, Public Health Service), and **SAEGER, ARMIN L., Jr.:** *Maternal health and socioeconomic status of nonreservation Indians. Public Health Reports, Vol. 83, June 1968, pp. 465-473.*

The incidence of toxemia, infection, and anemia among 329 obstetrical patients admitted to the Public Health Service Indian Hospital at Tahlequah, Okla., in 1965 was studied in relation to the socioeconomic and cultural characteristics of their families. Among the factors considered were probable social function according to Indian blood quantum, living standard, urban or rural residence, mothers' education, and length of prenatal care.

Forty-two percent of the families were classified as functionally In-

dian, 29 percent as functionally non-Indian, and 29 percent as indeterminate. Eighty-seven percent of the patients had poverty level incomes. Patients who functioned socially as Indians were more impoverished, more rural, and less educated than their functionally non-Indian counterparts.

The greatest number of the women made their first visit to the prenatal clinic during the 24th week of gestation, and 6 percent had no prenatal care. The mean number of visits was 6.3.

Toxemia occurred in 25 percent of the patients. Infection, most frequent in unmarried mothers, and anemia each occurred in 30 percent.

Patients with a lower standard of living had a higher incidence of toxemia of pregnancy, but no relationship between living standard and postpartum infection or anemia was observed. Racial and social function, educational attainment, and rural or urban living could not be related to maternal morbidity. Maternity care did not influence the occurrence of either toxemia or anemia, but patients who received no prenatal care had a higher incidence of genital tract infections than those who went to the prenatal clinic.

**KEYES, LYNFORD L.** (Illinois Department of Public Health), and **WITTENBORN, EUGENE L.:** *Setting health education objectives for local health departments. Public Health Reports, Vol. 83, June 1968, pp. 503-506.*

In late 1965, following 5 years' use, the health education section of "Standards for Local Health Departments in Illinois" was revised under the leadership of the State bureau of health education. An ad hoc committee of local and State health educators was formed, and its members prepared the revision. The revised section was designed to serve the entire staff of a local health department rather than solely the health educator or health education unit.

Although it was recognized that

health education objectives of the revised section could more readily be attained by employing a health education specialist, all staff members of a department were expected to fulfill the health education objectives whether or not there were health educators on the staff.

The revised health education section encompassed the following actions: the integration of the educational components in all public health practice—planning, operation, and evaluation; the responsi-

bility of the health department to interpret to the community information about timely health problems, hazards, and issues; the need for continued assessment and development of staff in their interpersonal relationships with the public; the fostering of inservice and continuing education programs for health department personnel, volunteers, allied health personnel, and lay groups.

Before it was approved, the revised health education section was reviewed by a panel of out-of-State experts consisting of public health administrators, school of public health faculty, and Federal, State, and local health educators.

**POLAND, JACK D.** (National Communicable Disease Center), **PLEXICO, KATHRYN, FLYNT, J. WILLIAM,** and **CHIN, TOM D. Y.:** *Poliovirus neutralizing antibody levels among preschool children. Public Health Reports, Vol. 83, June 1968, pp. 507-512.*

Serosurveys in Greater Kansas City involved a principal population group of 110 children from a low socioeconomic housing project (population A) and three smaller comparative populations. The comparative populations were a group of 37 children (population B) from a different low socioeconomic area sampled at the same time as population A, and a group of 20 children from low socioeconomic families (population C) and 28 children from a middle socioeconomic area (population D), both sampled 1 year earlier.

Of the 110 children in population A, about one-fifth were reported as unvaccinated and 45 percent as either not immunized or inadequately immunized. The minimum criteria for adequate immunization was two doses of oral attenuated live vaccine (OPV) or three doses of inactivated trivalent vaccine (IPV) or IPV plus OPV. One-tenth of these children were seronegative to all three polioviruses.

Overall seroimmunity to the individual polioviruses as measured by neutralizing antibodies varied from 65 to 85 percent; the lowest rates

were to type III and the highest to type II. More than a fourth of the children under age 3 had no detectable antibodies to each of the three polioviruses. Results were similar for populations B and C, but a considerably greater percent of children in the middle socioeconomic population D had antibodies to the polioviruses.

Even with the levels of seroimmunity demonstrated among low socioeconomic groups, an extensive outbreak of poliomyelitis is not likely to occur. However, if a virulent poliovirus were introduced into such a population, sporadic cases or even limited outbreaks of poliomyelitis could be expected, particularly among children under 3 years old.

**WEINER, LOUIS** (New York City Department of Health), and **BINDER, SIDNEY:** *Automation of source data for birth certificates. Pilot study. Public Health Reports, Vol. 83, June 1968, pp. 519-525.*

The National Center for Health Statistics and the New York City Department of Health cooperated in a study to process birth certificates by computer. Three New York hospitals in which about 8,000 births occur annually volunteered for the experiment.

The hospitals prepared the birth certificates on an electric typewriter which simultaneously produced perforated paper tape carrying the same information. The information on these tapes was later converted to punched cards for computer processing.

During a 4-month test period the three hospitals filed 2,542 birth

certificates. It is estimated that more than 50 percent of the records examined would be rejected by the computer as not processable, that is, as records in which the computer program could not separately identify and account for the required data entries.

In two hospitals where reliable measures of performance with the tape-generating typewriter were made, it took 3 to 5 minutes to type a certificate. Assuming a production time of 5 minutes a certificate for transcribing on paper tape the information on the 165,000 birth certificates filed in the City of New York in 1 year, 11 employees would

be needed to complete a year's certificates, two less than are now needed to code and punch the cards. This would save about \$10,000 a year. With this saving, the cost of the tape-generating typewriters could be recouped in about 4 years.

The greatest difficulty uncovered by the study seems to be in maintaining the proper orientation of the hospitals to the technical requirements of the system. Although the typewriters used had advantages in speed and quality of product over standard typewriters, it is unlikely that hospitals could justify the purchase of typewriters costing about \$3,000 for routine preparation of records and other typing functions. Hospitals using computers, however, might find the tape-generating typewriter more efficient than other input preparation devices.